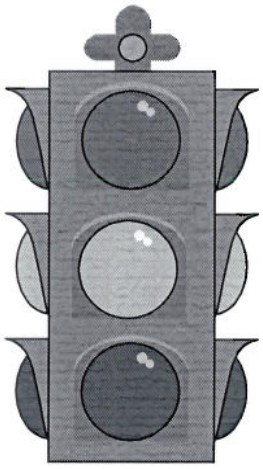
CITY OF CARLSBAD

TRAFFIC SIGNAL EVALUATION

POLICY



PREPARED BY:

TRANSPORTATION DIVISION

JANUARY 2008

CITY OF CARLSBAD

TRANSPORTATION DIVISION

TRAFFIC SIGNAL EVALUATION POLICY REPORT

JANUARY 2008

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A. TRAFFIC SIGNAL QUALIFICATION RATING SYSTEM

CITY OF CARLSBAD
Transportation Division

TRAFFIC SIGNAL EVALUATION POLICY REPORT

INTRODUCTION

The City of Carlsbad is located in North San Diego County and has grown from a small, agricultural based residential community in its early history to a city of approximately 101,000 residents. Numerous industrial, commercial, recreational, residential and agricultural land uses are found in Carlsbad. As a result of population increases in Carlsbad, there has been an increase in vehicular, bicycle, and pedestrian traffic.

With increased traffic volumes on Carlsbad's roadway system, there continues to be a need for a detailed methodology to evaluate and determine locations of future traffic signals. Currently, there are 173 signalized intersections in Carlsbad. Ownership and maintenance responsibility is as follows:

- 156 traffic signals owned and maintained by the City of Carlsbad
- 14 traffic signals owned and maintained by Caltrans.
- 3 traffic signals owned and maintained by other agency.

The purpose of this report is to identify and evaluate future traffic signals at various intersections throughout the City of Carlsbad. The Policy provides the mechanism to continually re-evaluate and update potential traffic signal locations on a regular basis.

The Traffic Signal Qualification List is not steadfast. Financial constraints, private development schedules, capital improvement projects and funding availability, or other valid considerations may dictate that a lower qualifying traffic signal be installed at a given location. The qualification list does, however, serve as a guide for future traffic signal installations and only those intersections that meet traffic signal warrants are listed.

BACKGROUND AND PURPOSE

When traffic volumes increase, the hierarchy of traffic control dictates that consideration be given to right-of-way assignment at intersections by various means. Depending upon the traffic and pedestrian characteristics and geometrics at a given intersection, staff will evaluate and select from a variety of traffic control options the appropriate device to facilitate the safe and efficient movement of vehicles and pedestrians.

Some of the different types of intersection traffic control devices or strategies include: basic rules of the road governing right-of-way at intersections, yield signs, two-way stop sign installations, three-way and four-way stop sign installations, channelization, center median control, turn restrictions, and traffic signals.

This report focuses on establishing a citywide listing of one of the most efficient ways of assigning intersection right-of-way control, the traffic signal. The purpose of a traffic signal qualification list is to compare and impartially rank the intersections under consideration using objective criteria and traffic data. The first Carlsbad Traffic Signal Qualification List was established in 1988 by City Council Resolution Number 88-252 and it has subsequently been updated in 1990, 1992, 1994, 1996, 1998, 2000, 2002, 2004, and 2006. This 2008 report is an update of the 2006 approved report and qualification list. All intersections included on the 2008 list have met one or more warrants contained in the Federal Highway Administration's (FHWA) Manual on Uniform Traffic Control Devices (MUTCD) 2003 Revision 1 as amended for use in California (California Manual on Uniform Traffic Control Devices) for the installation of a traffic signal.

POLICY

As with most traffic engineering departments, it has been the policy of the City of Carlsbad Transportation Division to only recommend installation of traffic signals that meet the minimum criteria adopted by the California Department of Transportation. All data collection and eligibility evaluation to determine if criteria is met for an intersection to qualify for a traffic signal is under the direction of the City Traffic Engineer.

GENERAL

Traffic signals are electrically powered traffic control devices that assign the movement of vehicles, bicycles, and pedestrians at an intersection. Traffic signals establish the positive assignment of the right-of-way to help facilitate the orderly movement of traffic and pedestrians with minimum delay and maximum safety.

Many cities use a priority list to rank future traffic signal projects. To qualify for this list, the traffic signal priority analysis takes into account the relative delays on approaching streets, the collision history at the intersection, gaps in the major and minor street streams of traffic, pedestrian volumes, and various other factors. An evaluation is then conducted to determine if a traffic signal will minimize or correct an identified problem.

Establishing a Traffic Signal Qualification List answers two basic questions:

1. Do traffic conditions at the intersection meet the basic criteria that affect the benefits and costs of traffic signal control; and

2. If so, how does this location compare with other locations throughout the City of Carlsbad that meet the same basic criteria?

This evaluation provides a rational method to compare one intersection with another, the end result being a ranking that shows the greatest need for signalization between all potential traffic signal locations. The attached Traffic Signal Qualification List indicates each intersection under consideration and is arranged in descending order based upon the total qualification points accumulated at each location.

A priority listing of future traffic signal locations does not mean that signals will exclusively be installed in the order of ranking. Existing conditions, right-of-way needs, need for left-turn or right-turn lanes, budget constraints, or other factors may indicate an intersection that is more suitable and appropriate for signalization than one higher on the list. The list establishes locations where preliminary engineering should take place and then be re-evaluated before proceeding to final design. Traffic signals are not installed unless written authorization from the City Engineer directs their installation or if the intersection has been approved by the City Council and is included in the annual Capital Improvement Program (CIP).

DATA

Over the years, traffic signal technology has experienced a technical evolution. Traffic signals have evolved from pre-timed signals where the control mechanisms operated on a predetermined time schedule to allocate a fixed amount of time for each interval in the traffic signal cycle to traffic actuated microprocessor units that can operate two to eight signal phases, highway ramp metering control, master controls for interconnected signal systems, traffic volume monitoring stations, video detection of vehicles, and adaptive traffic control systems.

Traffic signals are expensive control devices to install and under certain conditions more problems may be created than are solved. These problems can range from increased accident frequency, delays, increased air or noise pollution, and higher energy use, to causing drivers to follow circuitous travel along less desirable routes to avoid the signalized intersection.

A properly designed signalized intersection, however, can resolve many problems and provide advantages ranging from reducing certain types of accident frequency, delay, and air pollutants, to creating an orderly traffic movement. In a coordinated signal system, traffic signals help maintain an efficient, progressive movement of vehicle platoons along an arterial roadway.

Rankings of the various intersections in Carlsbad for potential traffic signal installation was accomplished by using a Traffic Signal Qualification Rating System. Points were assigned to seven qualification factors that are based on the California Manual on Uniform Traffic Control Devices.

Traffic Signal Qualification Rating System factors include the following:

Factor A - Minimum Vehicular Volume

This factor considers the fact that at certain traffic volume levels the delay can be reduced and orderly flow through an intersection enhanced by signal controls.

Factor B - Interruption of Continuous Traffic

The interruption factor applies when the traffic volume on the major street is so high that few gaps occur to permit the minor street traffic to cross or enter the intersection. As a result, the minor street traffic may suffer long delays or experience hazards at the intersection.

Factor C - Minimum Pedestrian Volume

The minimum pedestrian volume factor reflects the length and frequency of gaps available for pedestrians to cross the major street as compared to the total number of pedestrians that cross the street.

Factor D - School Area Traffic Signals

This factor recognizes the special problems or concerns that may be present at intersections near schools or on school walking routes. It is similar to the minimum pedestrian volume factor in that gaps in traffic are considered.

Factor E - Progressive Movement or Signal Systems

Existing or proposed signal systems are considered by this factor. Often traffic flow efficiency can be enhanced if signals are installed at proper spacing along an arterial or signal network. Such signals may assist in holding traffic in compact platoons that will arrive at adjacent signalized locations in accordance with a coordination timing plan.

Factor F - Accident History

This factor reflects the fact that certain types of accidents could be reduced by traffic signal control. However, experience has shown that few changes in accident frequency can be expected at a location that historically has less than five accidents per year, or an accident rate of less than about 1.0 accident per million vehicles.

Factor G - Special Conditions

This factor recognizes the special problems that may occur due to the location of certain traffic generators, specific geometric or roadway features, sight distance obstructions, and various other criteria.

The above rating system is used to evaluate various potential traffic signal locations; these locations are then ranked based on the following relative weight system:

FACTOR	DESCRIPTION	MAXIMUM QUALIFICATION POINTS	RELATIVE WEIGHT
A	Minimum Vehicular Volume	15	18%
B	Interruption	10	12%
C	Pedestrian Volume	10	12%
D	School Area	10	12%
E	Signal System	5	6%
F	Accident History	15	18%
G	Special Conditions	18	22%
TOTAL POSSIBLE		**83 POINTS**	**100%**

2008 TRAFFIC SIGNAL QUALIFICATION LIST

QUALIFICATION NUMBER	LOCATION CAPITAL IMPROVEMENT PROJECT FUNDING SOURCE/FISCAL YEAR	CALIFORNIA MUTCD SIGNAL WARRANTS MET	TOTAL VOLUME 2 P.M. - 6 P.M.	QUALIFICATION FACTOR							TOTAL QUALIFICATION POINTS
				A	B	C	D	E	F	G	
1	La Costa Avenue/Levante Street Developer Funded	1, 2, 3	4941	15	9	0	0	5	0	2	31
2	Faraday Avenue/Rutherford Road CIP/2009-2010	1,2,3	4467	15	6	0	0	5	1	2	29
3	Faraday Avenue/Palmer Way CIP 2009-2010	1,2,3	4135	11	7	0	0	5	0	2	25
4	Paseo del Norte/Ginger Ave./Harbor Point Rd. CIP 2008-2009	1,2,3,6	3700	10	6	0	0	5	0	2	23
5	La Costa Avenue/Nueva Castilla Way CIP 2008-2009	3	5524	5	0	0	0	5	0	5	15
6	La Costa Avenue/Esfera Street CIP 2010-2011	1,2,3	4442	6	0	0	0	5	0	2	13
7	La Costa Avenue/Gibraltar Street CIP 2010-2011	6	4804	4	0	0	0	5	0	2	11
8	Armada Drive/Grand Pacific Resorts CIP 2013-2018	6	2351	0	2	0	0	4	0	4	10
8	Carlsbad Boulevard/Cherry Avenue CIP 2011-2012	6	6633	2	0	0	0	5	0	3	10
10	Faraday Avenue/Camino Hills Drive CIP 2010-2011	1,3	3300	3	0	0	0	1	0	5	9
10	La Costa Avenue/Calle Madero CIP 2010-2011	6	4843	3	0	0	0	4	0	2	9
12	Tamarack Avenue/Pontiac Drive CIP 2013-2018	3,6	2403	1	2	0	0	1	0	4	8
13	Poinsettia Lane/Brigantine Drive Developer Funded/CIP 2013-2018	6	2810	1	0	0	0	5	0	2	8
14	La Costa Avenue/Camino de los Coches Developer Funded/CIP 2012-2013	3	1753	1	0	0	0	1	0	1	3

NOTE: The indicated year in the CIP is recommended, but has not been approved by the City Council.

DEVELOPER INITIATED OR CAPITAL IMPROVEMENT PROGRAM (CIP) TRAFFIC SIGNALS CURRENTLY BEING DESIGNED/CONSTRUCTED

1. Aviara Parkway/Camino de las Ondas
2. Calle Barcelona/Paseo Avellano
3. Poinsettia Lane/Black Rail Road
4. Rancho Santa Fe Road/Avenida La Cima

INTERSECTIONS INVESTIGATED

(Did not meet CAMUTCD Signal Warrants)

1. Armada Drive/Fleet Street (S)
2. Aviara Parkway/Nightshade Road
3. Aviara Parkway/Towhee Lane
4. Chestnut Avenue/Donna Drive/Donna Court
5. Chestnut Avenue/Valley Street
6. El Fuerte Street/Rancho Pancho
7. Grand Avenue/Madison Street
8. Las Flores Drive/Pio Pico Drive
9. La Costa Avenue/Quinta Avenue
10. Monroe Street/Hosp Way
11. Rancho Santa Fe Road/Avenida Aragon
12. Tamarack Avenue/Valley Street

APPENDIX

TRAFFIC SIGNAL
PRIORITY EVALUATION

Location: _____ _____

St. Classification: _____ _____

Approach Lanes: _____ _____

Approach Speeds: _____ _____

Priority Points

Factor A: Total Volume (2PM-6PM) (15 pts. max.)
- Major St. Total _____
- Minor St. Total _____
- TOTAL volume = _____

Factor B: Interruption (2PM-6PM) (10 pts. max.)
- Major St. Vol. _____
- Minor St. over 300 Yes No _____

Factor C: Pedestrian Volumes (2PM-6PM) (10 pts. max.)
- Major St. Vol. _____
- Ped Xing Major St. Vol. _____ _____

Factor D: School Area Pedestrian Volumes (10 pts. max.)
- 2 hour St. Vol. _____
- 2 hour Ped. Vol. _____ _____

Factor E: Signal Systems/Coordinate Movement (5 pts. max.) _____

Factor F: Accident History (15 pts. max.)
(Average/Year for 2 Years) _____

Factor G: Special Conditions (18 pts. max.)
Describe: _____ _____

_____

TOTAL POINTS = _____

PRIORITY ON SIGNAL LIST _____

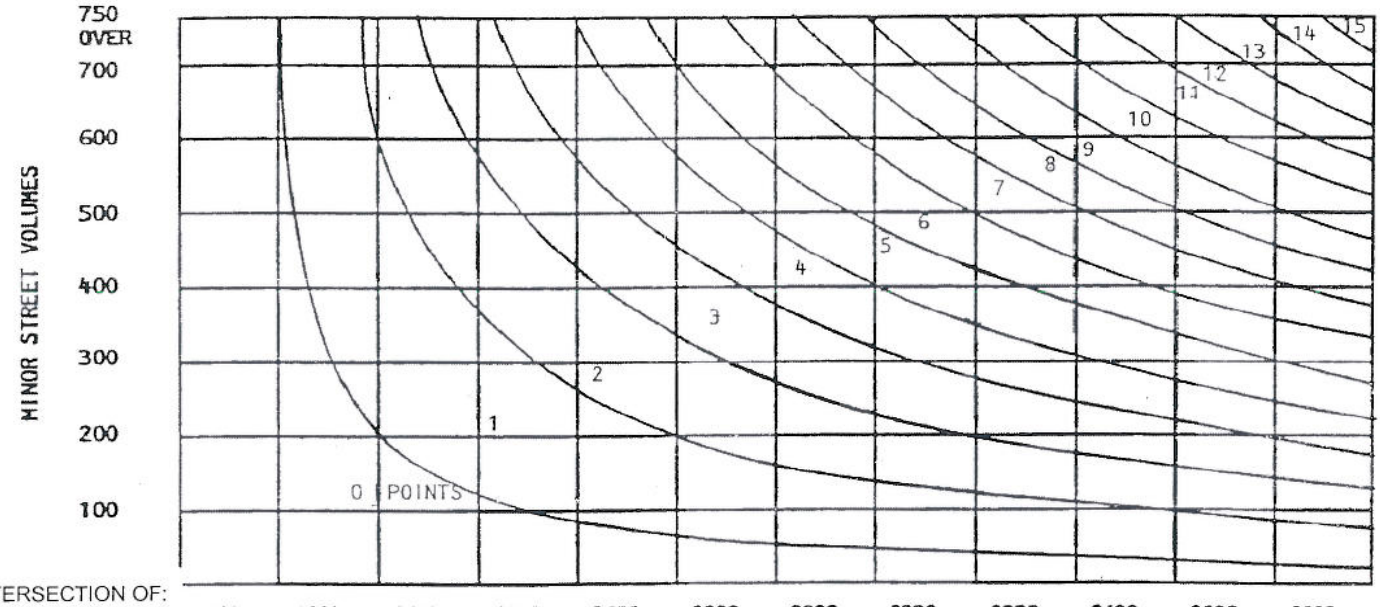
TRAFFIC SIGNAL QUALIFICATION RATING SYSTEM

Factor A - Total Vehicular Volume

Points are assigned based upon the graph below which considers major and minor street volumes and capacity. The entering volumes are based upon 4-hour counts (usually from 2:00 to 6:00 P.M. on a weekday). A maximum of 15 points may be assigned to this factor.

NOTES

1. ALL VOLUMES ARE FOR 4 HOURS (USUALLY 2-6 P.M.)
2. MAXIMUM POINTS = 15



INTERSECTION OF:												
2-2 Lane Sts.	1600	1800	2000	2200	2400	2600	2800	3000	3200	3400	3600	3800+
1-2 8 1-4 Lane St.	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400+
2-4 Lane Sts.	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800+
2-One-Way Sts.	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400+

TOTAL VOLUME ENTERING INTERSECTION

Factor B - Interruption of Continuous Traffic

Vehicles on through streets, if uncontrolled, tend to travel through minor street intersections at speeds that make it difficult and hazardous for vehicles and pedestrians from the side street to cross or enter the principal traffic stream. The total of the minor street vehicles plus pedestrians crossing or entering the major street must exceed 300 in four hours to receive any points. A maximum of 10 points may be assigned to this factor.

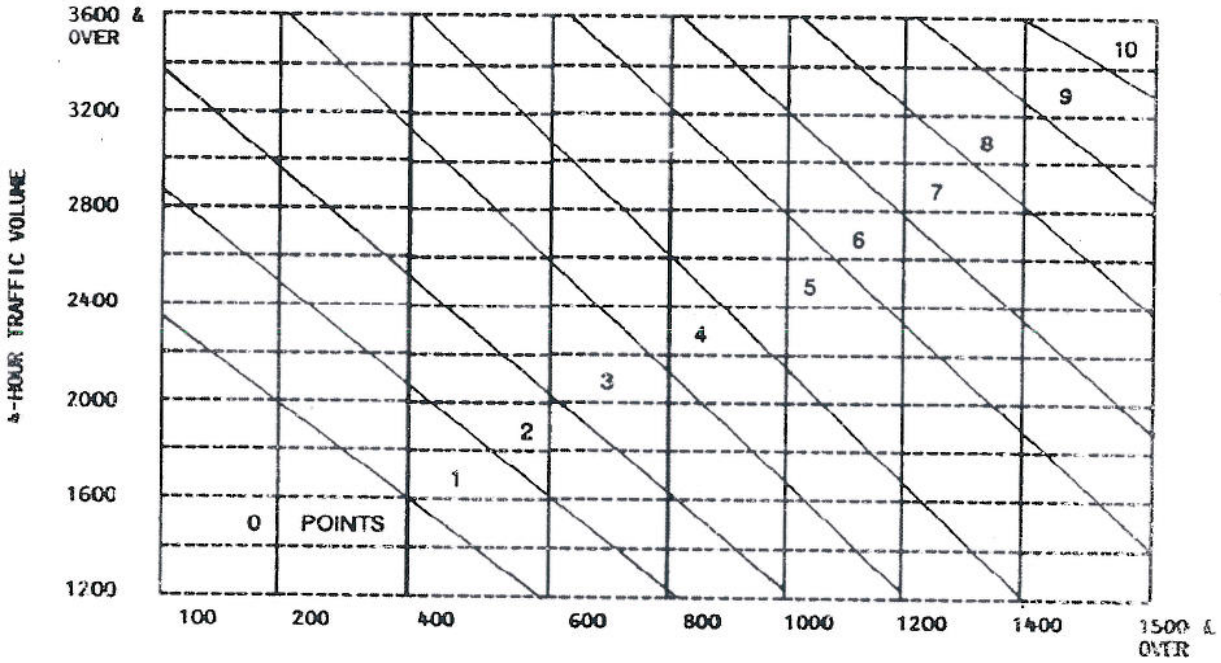
4-HOUR MAJOR STREET VOLUMES	POINTS	APPROXIMATE ADT
0-1649	0	4,700
1650-1949	1	5,600
1950-2249	2	6,400
2250-2549	3	7,300
2550-2849	4	8,200
2850-3149	5	9,000
3150-3449	6	10,000
3450-3749	7	10,700
3750-4049	8	11,600
4050-4349	9	12,400
4350-Over	10	12,500 And Up

Factor C - Pedestrian Volume

A traffic signal may be needed where many pedestrians cross a major street. A maximum of 10 points may be assigned to this factor.

NOTES

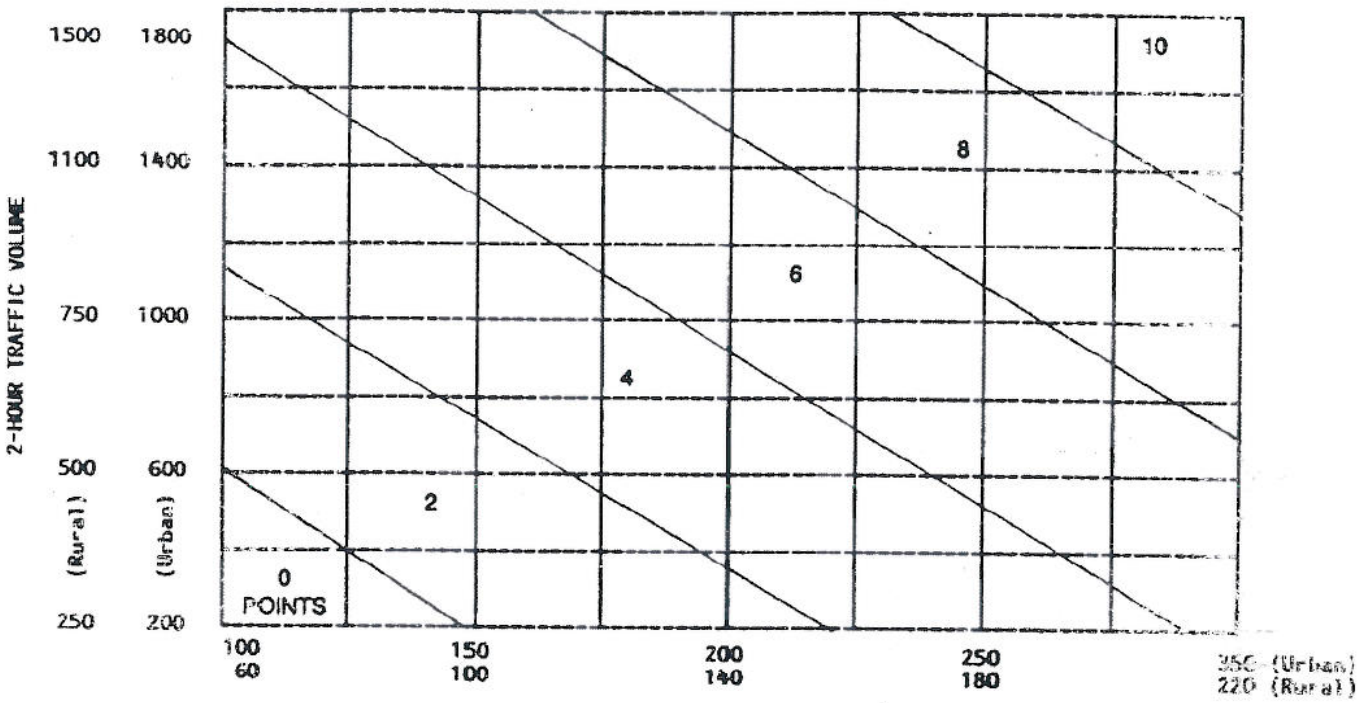
1. ALL VOLUMES ARE FOR 4-HOURS (USUALLY 2-6 P.M.)
2. MAXIMUM POINTS = 10
3. NO POINTS IF LESS THAN 100 PEDESTRIANS DURING THE 4 HOUR PERIOD.
4. NO POINTS IF LESS THAN 1200 MAJOR STREET VEHICLES DURING THE 4 HOUR PERIOD.



PEDESTRIANS CROSSING MAJOR STREET

Factor D - School Area Traffic Signals

Points are assigned based upon the number of school age pedestrians crossing the major street as compared to the major street traffic. This factor will apply only to locations within one mile of a school and where the nearest controlled intersection or potential crossing point is more than 600 feet away. A maximum of 10 points may be assigned for this factor.



PEDESTRIANS CROSSING THE MAJOR STREET
(Per 2-Hour Period)

NOTE: No points will be assigned if nearest controlled crossing is less than 600 feet away.

Factor E - Progressive Movement or Signal Systems

This factor depends upon engineering studies and must include the present and future traffic demands of the area. A signal may be justified when it forms a part of an interconnected or coordinated system. A maximum of 5 points may be assigned to this factor based on the distance to the nearest traffic signal as indicated below.

Distance to Nearest Traffic Signal	Points
<1,200 feet	5
1,201 feet – 1,500 feet	4
1,501 feet – 1,800 feet	3
1,801 feet – 2,100 feet	2
2,101 feet – 2,600 feet	1
>2,600 feet	0

Factor F - Accident History

Only those accidents susceptible to correction by traffic signals are considered and then only if less restrictive measures such as warning signs, proper lighting, painted markings, etc. have failed. A maximum of 15 points may be assigned to this factor.

ACCIDENTS	POINTS
0-2	0
3	1
4	3
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15 & Over	15

NOTE: Use the average of the last two years, provided the intersection has been in operation for two years.

Factor G - Special Conditions

This factor considers extenuating circumstances that are not covered in the previous six factors. These may include: the proximity of schools, churches, public buildings, and other traffic and pedestrian generators; an abrupt change from a rural to an urban area; the need for police control during portions of the day; a steep hill; a horizontal curve; restricted sight distance. This factor requires engineering judgment based on physical inspection of the site. A maximum of 18 points may be assigned to this factor.

A summary of the factors considered to be special conditions and the points that were assigned follows:

1. Four-way STOP Control (5 points): Typically, right-angle accident frequency drops sharply after installation of a Four-Way STOP. However, total delay, as well as rear-end collision frequency, increase to a level higher than that which would be reflected by the results of Factors #1 and #2.

2. Proximity of a school (1 to 5 points): Depending on the type of school and its distance from the intersection in question, points are assigned to reflect the potential benefit to school-age pedestrians and bicycle traffic.

3. Horizontal and Vertical Curvature and Visibility (1 to 5 points): The alignment of a major street can affect the visibility available to side-street motorists, and the relative safety of their crossing or merging maneuvers. There may also be other restrictions to visibility, such as utility poles and appurtenances and trees and shrubs on private property.

4. Speed on a Through Street (1 to 3 points): In addition to worsening the problems caused by visibility restrictions, speeds above critical can worsen the severity of the accidents which occur. Points are assigned based on the number of miles per hour the 85th percentile/critical speed is over the posted speed limit as indicated below.

# of MPH the 85th Percentile/Critical Speed Is Over the Posted Speed Limit	Points
1-2 mph	1
3-4 mph	2
5+ mph	3